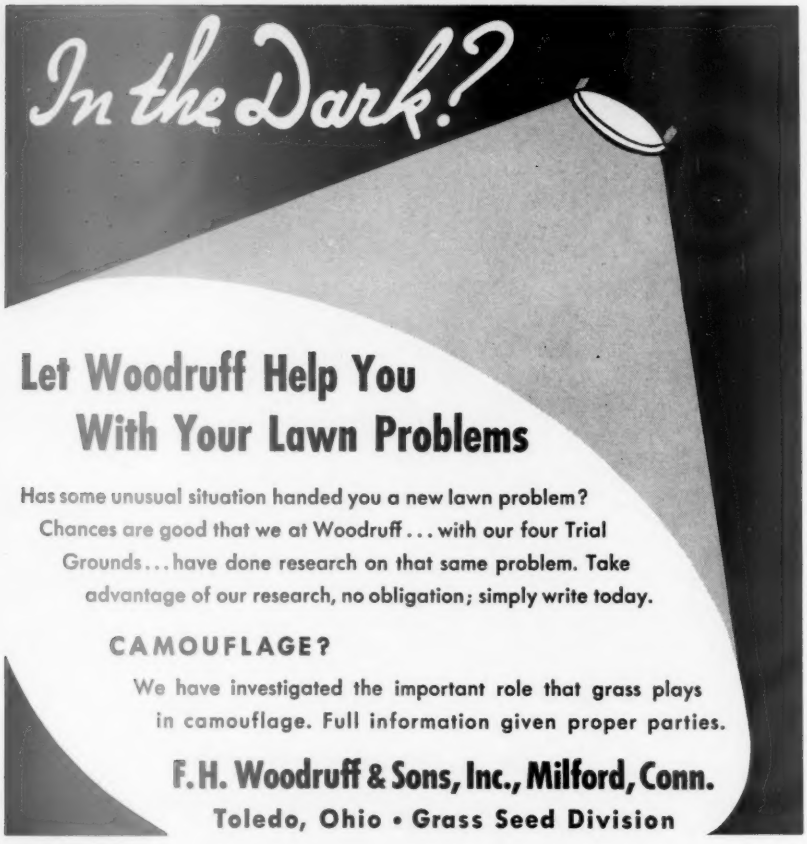
Trees.

The World Famous "Wawona" or Tunnel Tree *(Sequoia gigantea)* in Yosemite National Park, Calif.

VASCULAR CHEMOTHERAPY — *G. A. Zentmyer, Jr.*

ENVIRONMENTAL FACTORS IN TREE DECLINE — *Miller & Roewekamp*

August, 1943 — *The Journal of American Arboriculture* — 25 Cents



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Vol. 6 No. 1

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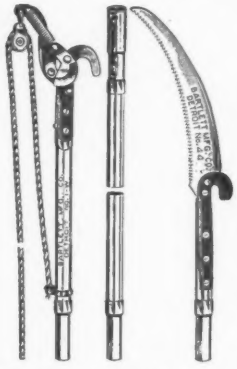

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TREES Magazine is a bi-monthly Journal published at Santa Monica, California, by Edward H. Scanlon, and is devoted to the furtherance of the technical and business administration of Trees (Street and Ornamental); Parks (Municipal and National); and Forests (State, National and Private), in the U. S. P. O. Box 886, Santa Monica, California. Subscription by mail, $1 per year; outside United States, $1.50. Advertising rates upon inquiry. Unsolicited manuscripts must be accompanied by postage return.

ALONG THE WAY

With . . . EDW. SCANLON

Please note: This will be the last issue of Trees this year. There were only two issues because of the difficulties involved in the Editors service in the Navy. It is too difficult to do a good job in both places. However, subscriptions that are unexpired will be continued as soon as we go back into publication.

■ While many people are STILL ENGAGED in their ARBORICULTURAL PURSUITS they just DO NOT SEEM to have their HEART SET IN going further—well THAT'S UNDERSTANDABLE, we'll all be PLEASED, to put it mildly, to GET BACK TO NORMAL. However that doesn't help our GOOD FRIEND FORREST STRONG at MICHIGAN STATE COLLEGE, East Lansing. FORREST has been ENTRUSTED by the NATIONAL SHADE TREE CONFERENCE to begin ACQUISITION of a PHOTOGRAPHIC SLIDE LIBRARY—both BLACK AND WHITE AND KODACHROME. FORREST is HAVING TROUBLE. Let's get some good tree slides in color ON THE WAY. I'm sending a kodachrome of the RED FLOWERING EUCALYPTUS (EUCALYPTUS FICIFOLIA) its fair and SHOULD be a start on a COMPLETE STORY of this fine tree.

* * *

■ *After MANY MANY months GUS BEILMAN has sent us an interesting follow up on the TREE SERIES ARTICLE by L. C. CHADWICK on KOELREUTERIA PANICULATA in the APRIL 1940 issue of TREES. GUS has PROMISED to dig up and send us the pix OF CAVITY WORK mentioned in HIS ARTICLE which appears in THIS ISSUE. We think it will be a VERY INTERESTING STUDY, particularly with a picture of the CAVITY CONDITION as it EXISTS TODAY.*

* * *

■ We have SOMETHING to LOOK FORWARD to as a letter from H. J. HOHMAN, KINGSVILLE NURSERIES (Md.) promises some NEW ITEMS on FASTIGIATE TREES. This tree form is DEFINITELY A FAVORITE with MR. HOHMAN as it is WITH "ALONG THE WAY."

* * *

■ *So the TIME COMES for the POLITICAL TOM-TOMS. They are DRUMMING OUT the most ANCIENT of political "HORSE-AND-BUGGY" war chants—"DON'T CHANGE HORSES IN THE MIDDLE OF A STREAM"—What if THE HORSE is a POOR SWIMMER?*

* * *

■ The FINEST CONTRIBUTION AMERICA can make to postwar PEACE AND PLANNING would be TO ADOPT the SAGE ADVICE of the GREATEST AMERICAN, GEORGE WASHINGTON, who made TWO STATEMENTS that TIME and EVENTS have proven—"IN TIME OF PEACE PREPARE FOR WAR" and "STAY OUT OF FOREIGN ENTANGLEMENTS." The FIRST would TAKE CARE of the SECOND, also would keep the BAD BOYS IN LINE if our FOREIGN POLICY were pursued INTELLIGENTLY, UNSELFISHLY and VIGOROUSLY.

* * *

■ *BOB WEAKLEY says he is busy keeping the WOLF AWAY from the door. THAT WOLF had better STAY AWAY from WEAKLEY'S DOOR or he'll WIND UP as a "WIMPY-BERGER."*

* * *

■ The mail brought two welcome letters from "Souse" America. Professor FRED VOGEL, formerly at MICHIGAN STATE, is now with a RUBBER DEVELOPMENT outfit in MANAOS, Brazil; he says TREES was FORWARDED to him and that 14 OTHER FORESTERS gave it the ONCE OVER. The other GOODWILLER is BOB CUNNINGHAM of SHREVEPORT, LA. Bob is in SAO PAULO, BRAZIL, and only HAD WORDS of PRAISE for the Many BEAUTIFUL TREES he SAW THERE.

* * *

■ *EVEN THO 'this is the SECOND AND LAST issue of TREES THIS year we'll try to put out AT LEAST TWO ISSUES next year if the war STILL GOES ON. We hope YOU WILL NOT STOP your interesting LETTERS and WORTHWHILE CONTRIBUTIONS of items, PICTURES and OTHER MATERIAL. We'll be READY TO GO when the DOVE OF PEACE flies again.*

THE COVER PICTURE: The world famous, and most photographed tree known, is the subject of our cover for this issue of TREES. Mr. Frank A. Kittredge, Superintendent of Yosemite National Park, was kind enough to send us this excellent photograph for which we are very grateful. This 'big tree,' (Sequoia gigantea) is known as the Wawona or Tunnel tree and is located in the Wawona Grove in Yosemite National Park. Just who conceived the idea of tunneling through this tree, or why, we cannot determine, however it seems that the butt of the tree had been severely burned down through the ages and the tunnel is an extension of this fire scar. The work was done in June 1878 ("The Trees of Yosemite," Tresidder and Hoss) and is 26 feet long. Other measurements of the tree are: Height, 231 feet; diameter at base, 27.5 feet; diameter 10 feet above ground, 19.5 feet; girth at base, 86.4 feet.

* * *

■ When Trees RESUMES A REGULAR SCHEDULE we would like to PUBLISH PICTURES of the BEST PLANTED, most BEAUTIFUL STREETS of trees in the United States. WHY don't you CIVIC MINDED Arborists, Park Supers and others GIVE YOUR TOWN A BOOST by sending in ONE OR MORE pictures.

ODDITREES

☆

Nature plays some funny pranks on some of its tree children and this Odditree is one of them. Altho Ross McIntire of the Los Angeles Park Dept. who sent in the accompanying picture did not know how this Black Acacia *(A. melanoxylon)* acquired its unorthodox shape, a guess would be that someone tried to tie a knot in the crown when the tree was a supple sapling. It was evidently a slip knot that only partially took effect.

☆

August, 1943 *The Journal of American Arboriculture* Volume 6 — No. 1

EDWARD H. SCANLON, Editor
P. O. Box 886—Santa Monica, California

"No place is complete without trees. A home without trees is charmless; a road without trees is shadeless; a park without trees is purposeless; *a country without trees is hopeless*"

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CORDIALLY YOURS

ALL DRESSED UP—NO PLACE TO GO

Why don't we ask ourselves a question?

Aren't we permitting our fields of horticultural endeavor to drift aimlessly about, without taking advantage of the many fine opportunities for worthwhile publicity?

The answer we firmly believe is an emphatic—Definitely Yes!

We need a plan, a course to follow; our various professions whether it be the Arborist, Landscape Architect, Park Executive, Nurseryman and others are all noble, fine fields in which a man may labor. There can be no finer contribution to the advancement of civilization than .the growing of plants and the embellishment of cities, homes, buildings or roadsides.

These things are simple, fundamental. They are things every man can understand and learn to appreciate, love and advocate. Appreciation, love and support will result if the values and satisfactions to be derived are properly brought to the attention of uninformed people.

We must make a beginning—but where?

In business, whether it be war or legitimate, you try to make all shots count. Publicity and advertising programs must tie into some sales plan. But what do we do in a publicity sense? Practically nothing. Publicity of a constructive nature would mean more and better business for all, as well as a greater opportunity to embellish cities, homes, parks, thereby rendering a splendid contribution to better living.

The finest and latest example of our policy of being "all dressed up with no place to go" is the recent spread given to trees in LIFE Magazine for June 28th. If you did not see this beautiful spread of kodachrome pictures with a story and diagram showing the life function of a tree you should by all means pick up a back copy. The story and pictures covered about eight pages and could not help but create widespread interest in growing things. However, think of the greater, hundred-fold greater value that such publicity would have been to horticulture had there been some event or plan to which it could have served to focus the attention of the public. Such a fundamental cornerstone of all these professions could and should be a *National Arbor Day*.

Isn't it reasonable to expect that if the editors of such a national publication as LIFE saw material of general public appeal in this spread of tree pictures that other editors and publishers would also be receptive to similar spreads? To this we would say, Definitely yes, and Doubly yes if they had a concrete objective and a knowledge that they were contributing to a program that would make America more livable and fruitful and productive of timber. If they could tie such releases in with a National observance of Arbor Day you would find them clamoring for such mate-

rial—*Because people love trees, but they have to be told and shown.*

A committee of the Western chapter, National Shade Tree Conference has been formed to set up an organization for the purpose of establishing a National Arbor Day. Sub-committees are being formed by the various committee members, who represent each field and profession. A start has been made and your support is badly needed. Your opinion is solicited—may we hear from you.

Unified Observance of Arbor Day Plan Launched

Passing over, with hardly more than a shrug, the fact that no single date would serve as a practical planting day throughout the 48 states, the western chapter of the N. S. T. C. at its 10th annual meeting May 20th in Los Angeles, enthusiastically voted approval of a suggestion calling for the adoption of a National Arbor Day.

The combined opinion was that the observance and celebration of Arbor Day on a single day would be an opportunity for tremendous publicity and activity and would unquestionably become the cornerstone from which would spring a thousand-fold greater interest among the public for more beautiful cities, for lovelier homes, better parks and more attractive streets and highways —through planting.

The conference appointed as chairman of the committee to pursue this program, Edward H. Scanlon, editor of Trees. The incomplete committee named to date include: Ralph D. Cornell, American Society of Landscape Architects (sub-committee for landscape architecture) Woodbridge Metcalf, professor of Forestry, University of California (sub-committee for Forestry) Gilbert L. Skutt, Supt. of Parks, Los Angeles, (sub-committee for Park executives) Wm. Hertrich, curator Huntington Botanic Garden, (sub-committee for Botanic Gardens) H. Dana Bowers, California State Landscape Engineer (sub-committee for State Highway Landscape Engineers) Karl Amalia, National Aborists Association and Karl Raahauge, Wilcox Nurseries, Montebello, Calif., (sub-committee for Nurserymen). Mr. Scanlon's sub-committee will be editors and publishers. Many more persons will be invited to join the committee and sub-committees.

The committee has begun to function having received letters from the following governors: John W. Bricker of Ohio, who referred the proposal to his conservation dept.*; Leverette Saltonstall of Massachusetts, who "feels much might be gained by a unified observance of Arbor Day;" Raymond E. Baldwin of Connecticut, "I would be in hearty accord with a National Arbor Day;" Thomas E. Dewey of New York. Governor Dewey has referred the matter to the state departments involved and will answer as soon as possible; Governor Charles Edison of New Jersey. The Dept. of Conservation advised that a single day was not possible for planting; that if adequate publicity were given to Arbor Day as designated in each state the result might be just as satisfactory as nation-wide publicity for one day only. *(Eds note: This brings up a good point);* Robert O. Blood of New Hampshire—"I agree with you, but think that this is the type of legislation which should be left until after the war."

The point brought out by the New Jersey governor can be countered. As far as radio, newspaper and magazine publicity is concerned, the editors, managers and publishers *are ever on the look-*

(Continued on next page)

*The gist of the answer from the Ohio conservation dept. was "I am sure that Ohio will be willing to cooperate."

National Committee for National Arbor Day. L. to R. first row; Dr. W. H. Chandler, Dean, School of Agriculture U.C.L.A.; Ralph D. Cornell, Fellow American Society of Landscape Architects; Wm. D. Hertrich, Curator Huntington Botanic Gardens; Standing:—Woodbridge Metcalf, Professor of Forestry, University of California; H. Dana Bowers Landscape Engineer, California Division of Highways; Edward H. Scanlon, Chairman, Editor of Trees; Karl Amalia, Hartney & Amalia, Boston, Mass.; Karl Raahauge, Wilcox Nurseries, Montebello, California .

WAR CANCELS NATIONAL SHADE TREE CONFERENCE

The 19th National Shade Tree Conference definitely has been postponed owing to the request of the Government that transportation be curtailed as much and wherever possible in order to further facilitate movement of troops and materials vitally need in the war effort. This decision was just reached by the executive commmittee and forwarded to TREES by Dr. L. C. Chadwick, Executive Secretary. The Proceedings will be published as usual with invitational papers as well as the Proceedings of the Western and Southern Chapters.

If your membership is in arrears or if you are not a member of this foremost tree organization, may we remind you at this time your membership support is needed. Contact Dr. L. C. Chadwick, Ohio State University, Columbus, Ohio.

out for worthy causes. But their space and time is very valuable and they cannot nor would not spread out a program over a period of three or four months. However, the committee after several contacts is convinced that editors and others definitely will cooperate in publicizing a worthwhile venture if the observance can be held on a single day.

America needs more street and highway trees; more shade trees; fruit trees, and decidedly more forest trees. Planting on Arbor Day would be confined principally to ornamental trees but the consciousness engendered could very easily then be transmitted to other needs. As for the actual planting operation that could be done at the proper time of the year and the ceremonies, publicity and pictures could be reserved for the single National Arbor Day.

Arbor Day was originally fathered by J. Sterling Morton in 1872 (see editorial, May 1943 issue of Trees) when as governor of Nebraska he proclaimed the first Arbor Day. The date was later legalized in that state as April 22, Governor Morton's birthday.

This date would be an ideal one both sentimentally and because it would be suitable for actual planting in a majority of states. April 22nd was adopted by the conference as the date best suited for the suggested unified observance.

As Arborists, Park administrators, Nurserymen, Foresters and Landscape Architects, you are vitally interested in the betterment of your profession, you can be a valuable asset in this effort if you contact Garden Club members in your town or city; other people in horticulture; prominent people, in fact anyone interested in the worthy cause of better living in America, to help in this crusade—remember though only if you write and tell us will we know that you approve and endorse this effort.

A National Arbor Day could be used to encourage the planting of more living memorials to war heroes such as this Victory Drive of Sabal Palmettoes in Savannah, Georgia. The planting was made after World War I and is 18 miles long.
—*Photo Courtesy Savannah (Ga.) C. of Commerce*

Street Tree Survey Dormant for Duration

Compilation of the numerous charts that have been returned by collaborators in the street tree survey, begun in the July 1940 issue of TREES, has been temporarily halted until after hostilities cease. Of the twelve sections set up for the survey thruout the country, five are ready for final tabulation; some little work needs to be done before the other sections will be complete. The national committee and section chairmen have cooperated splendidly and when the results are published there will be available the most complete and comprehensive data ever assembled on the shade and street trees of this or any other country. In the meantime if there are any collaborators who have not yet completed their charts please do so at your earliest convenience and return it to TREES. Or if you wish a chart we shall be happy to send you one.

THRU the MICROSCOPE

By P. P. Pirone
New Jersey Agricultural Experiment Station

Wound Healing: When arborists get together to talk shop, one question that always ends in considerable diversity of opinion is that pertaining to the rate at which tree wounds heal. Some will say that a 6-inch wound near the trunk base will heal within 2 or 3 years; others, that it will never close up.

Some light was thrown on this highly controversial subject in a report by Roth and Hepting (1) as a result of several years of close observation. Although the studies were made on oak sprout stands in woodlands, similar results should hold for trees in ornamental or street plantings. Their observations were made and recorded over a five-year period—one much longer than most arborists could afford to spend and still stay in business.

Roth and Hepting found that 27 per cent of the wounds from 1 to 2½ inches wide and 5 per cent of those up to 4 inches wide were closed at the end of 5 years, and none larger than 4 inches were completely closed. Small wounds naturally have a smaller area that has to be closed. They observed that small wounds healed at a much faster rate than large ones.

Another interesting observation was that because of bark die-back, most wounds were larger at the end of one year than they were originally, even though flush cuts were made and the work done as carefully as possible. Four years elapsed before wounds 5½ inches or larger came back to their original size.

Tree Injections: Always a live topic, the matter of tree injections as a means of curbing diseases and insect pests, has been the subject of considerable publicity and increasing research during the last three years. Readers of TREES are well-aware that the efficacy of inserting chemicals into trees to destroy fungi growing in them is a highly controversial subject.

Without definitely solving the problem one way or another, several recent reports of interest to the readers of this department should be mentioned. Dr. Curtis May, well-known U. S. D. A.

(Continued on page 12)

VASCULAR CHEMOTHERAPY

By GEORGE A. ZENTMYER, JR.
Connecticut Agricultural Experiment Station
New Haven, Connecticut

The possibility of controlling plant diseases by treating plants internally with chemicals (chemotherapy) has aroused the interest of scientist and layman alike for a number of years. Chemotherapy has had a wide appeal, but lack of convincing success in the sporadic attempts at controlling plant diseases by this method during the past 20 or 30 years has resulted in skepticism as to its value. Recent rapid strides in many scientific fields, including in particular medical chemotherapy and plant physiology, however, have made it increasingly apparent that chemotherapy is potentially a highly productive approach to plant disease problems.

Synthesis of organic chemicals on a large scale, including the well-known "sulfa" drugs, has played a vital role in the development of chemotherapy for control of human diseases, and is a contributing factor to the increased interest in plant chemotherapy. The introduction and spread in this country of the virulent Dutch elm disease has been an added factor in stimulating research in chemotherapy for controlling diseases of trees.

Since its discovery in this country in 1930 the Dutch elm disease has spread rapidly into areas of high shade tree value. Unfortunately for the New England elms this is a vascular or wilt type of disease, in which the casual fungus develops inside of the tree, in the sapwood, instead of attacking exterior parts as do most pathogenic fungi. The vascular disease problem has been an enigma to the plant pathologist; for many years his "control" measures for this unusual type of trouble have been "use resistant varieties" and "rotate crops." Neither of these recommendations can help the arborist in his attempts to prevent or control disease in individual valuable trees.

What is obviously needed in combating the wilt fungi is a chemical approach, radically different from that made on the usual leaf spot, blight, and canker problems where eradicant or protective sprays either reach the fungi directly or protect surfaces which the fungi may invade. Chemotherapy, involving as it does introduction of chemicals directly into the sap stream where the vascular fungi develop, provides a promising approach.

Advanced case of Dutch Elm disease. The few remaining leaves are small and curled; the water system is heavily plugged with gums and tyloses.

—*Photo by B. W. McFarland*

The Connecticut Agricultural Experiment Station at New Haven, several other State Experiment Stations, and the U. S. Department of Agriculture have begun investigations on chemotherapy during the past two or three years, with particular reference to the Dutch elm disease. In addition, experiments on control of vascular diseases of vegetable crops by chemotherapy have been initiated at the Connecticut Station. Here the object is to find chemicals which can be introduced directly into the vascular system of plants and which will control wilt fungi or prevent their development, without causing appreciable injury to the host; and of course to develop satisfactory methods for adequate distribution of the chemical in the plant. This is an extremely large order.

Definite progress has been made in the right direction, however, and we know considerably more about the reactions of the vascular fungi, how various chemicals affect these fungi and their toxins in the laboratory and in the field, how plants react to various amounts and concentrations of organic chemicals, about methods of applying chemicals internally, and about the limitations of the field.

Research in chemotherapy has much in common with many phases of physiology, including investigations on vitamins, toxins, plant nutrition, mechanism of fungicidal action, and the nature of resistance of plants to disease—to mention some of the closely allied fields. It is of interest to consider the relation of some of these problems to chemotherapy.

The physiology of fungi is an extremely important phase which is all too often entirely overlooked in attempts to control plant diseases. For example, why is *Ceratostomella ulmi*, casual agent of the Dutch elm disease, a pathogenic fungus? How does it cause disease? Does it produce a toxin comparable to the toxins produced by many bacteria causing diseases of man? What growth substances and vitamins does it require; why can it kill an American elm and not a Siberian elm, and so on, ad infinitum?

(Continued on page 16)

Large Crowd Features Western Chapter Conference

A surprisingly large attendance featured the 10th annual meeting of the Western Chapter of the National Shade Tree Conference held in Los Angeles last May 20th. With the multitudinous rations and restrictions only a small group was expected but when all returns were in the record showed 110 registrations.

The meeting was held in the open under the picturesque California sycamores in Arroyo Seco park, one of the Los Angeles Park departments nicer small places.

Only a few papers were on the program while several movies mixed in made the program one of the most interesting of the series. The movie by the Army Camouflage Section was a fine thing that gave all members a new concept of the field of protective concealment as practiced under advanced line operations.

The roundtable on postwar street tree planning was ably conducted by Sergeant Karl Amalia; however, judging from the series of short talks not too much has been planned along lines of streamlining activities or modernizing planting and maintenance on a more efficient business basis. Perhaps City Planners and road builders will have to lead the way and take the play away from City Foresters and Park Administrators unless they project plans that will be more broad in scope than just merely the planting and care of trees and shrubs. Some new ideas on roadways might help.

One important discussion centered on the subject of a National Arbor Day. This proposal which was first projected editorially in the May 1943 issue of TREES was debated enthusiastically, and on the suggestion of the Conference a resolution was adopted to form a committee to seek establishment of a uniform observance of Arbor Day. The chairman of the committee selected by the Conference is Edward H. Scanlon, editor of TREES, who immediately named the following committee to coordinate various groups in support of the movement: Ralph D. Cornell, Landscape Architect; William D. Hertrich, Curator, Huntington Botanic Garden; Dr. W. H. Chandler, Dean, School of Agriculture, U. C. L. A.; Gilbert L. Skutt, Supt. of Parks, Los Angeles; H. Dana Bowers, California Div. of Highways, Landscape Engineer; Karl Raahauge, Wilcox Nurseries; Karl Amalia, Hartney & Amalia, Arborists. Other committee members will be invited and subcommittees formed.

Another resolution backing Professor Woodbridge Metcalf's Cork Oak planting in California was adopted.

The meeting, in spite of war conditions, was acclaimed by all as one of the finest in the ten year history of the Western group; location of next year's meeting place was deferred. The same officers were voted back in office, Professor Pierre Miller, U. C. L. A., President; E. S. Whitaker, Asst. State Landscape Engineer, Vice-president; Edward H. Scanlon, Editor of TREES, Regional Secretary, and Dale Griggs, Supt. of Parks, Santa Ana, Treasurer.

Environmental Factors In Relation To Tree Decline

☆ ☆ ☆

Figure 2 (Top) At left a collapsed deodar tree. At right, a collapsed magnolia. Note palm trees in background which show only slight symptoms of injury.

Figure 1. (Below) At left, healthy deodar tree. Tree in background at left shows symptoms of decline. At right, magnolia showing decline symptoms.

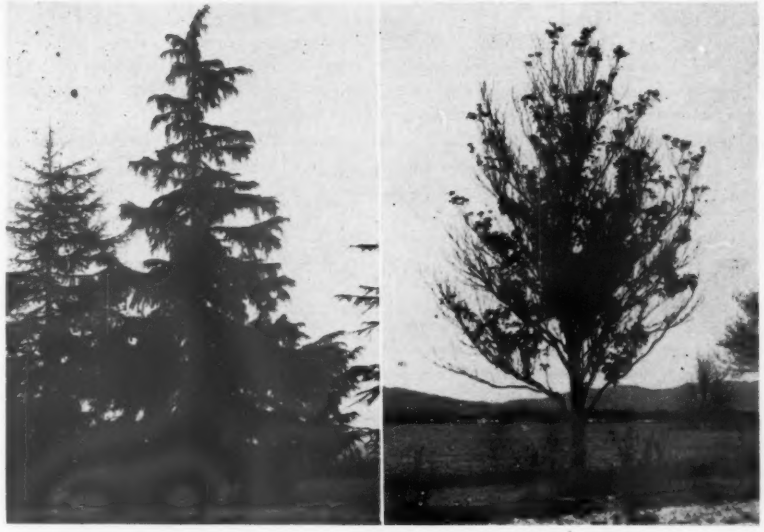
—Photos courtesy the Authors

P. A. MILLER
Associate Professor of Plant Pathology, University of California
F. W. ROEWEKAMP
City Forester, Park Department, City of Los Angeles

In May 1941, the attention of the writers was called to a sudden decline and death of many large roadside trees along portions of Chandler Boulevard and Sherman Way in the San Fernando Valley.

Many other instances of abrupt withering or sudden "collapse" and death of ornamental trees, shrubs and vines has been observed in this area and elsewhere in other years. The association of certain environment factors with the occurrence of this decline or collapse had been noted but had not been investigated. The present paper presents data obtained during the course of a study of these conditions and their relation to tree decline.

The original street tree planting was made by the Mission Land Company about 1910 or 1911. From the town of Lankershim (North Hollywood) it followed the Pacific Electric Railway right of way eastward along Chandler Boulevard to Van Nuys Boulevard, thence northward on Van Nuys Boulevard to Sherman Way and thence westward along Sherman Way to the terminus of the railway line on Shoup Boulevard beyond Owensmouth (Canoga Park). Some of the original sixteen mile planting was lost as a result of the low temperatures during the "freeze" of



1913, but were replanted. The large trees which now survive can be assumed to be at least thirty years old.

It was evident that during this thirty year period and at some time prior to 1941, some trees of the original planting had died and been removed, especially in places along Sherman Way between Reseda and Canoga Park. Notes on the drainage situation in San Fernando Valley made by Mr. Walter W. Weir, Drainage Engineer of the California Experiment Station, in July 1922, were obtained through the courtesy of Professor Martin Huberty of the University of California Division of Irrigation. The heavy and continued rains of the winter of 1921-22 are mentioned as having accentuated conditions due to poor drainage and in a number of instances to have brought about the complete ruin of peach, pear and apricot orchards. A review of investigations by the Los Angeles County Farm Advisor's Office "disclosed the fact that over an area covering 12 to 15 square miles there can be detected some deleterious efects of a high water table. Over a smaller area, probably 5 or 6 square miles the effect is serious . . . Along Sherman Way between Marion (Reseda) and Owensmouth (Canoga Park) certain of the shade and ornamental trees have been killed."

The notes further state "this affected area is of rather irregular shape lying in the trough of the valley and extends from about one mile east of Marion to about one mile west of Owensmouth with Sherman Way running approximately through the center. Test holes put down in some of the particularly bad areas showed a water table within two to three feet of the surface."

Trees Affected and Symptoms Exhibited

In December 1941 a survey was made to determine the kinds and number of ornamental trees which had been severely affected or killed. The total number of such trees counted at that time was 217. Of this number 198 were deodar cedars *(Cedrus deodara)*, 15 magnolias *(Magnolia grandiflora)*. 2 Monterey pines *(Pinus radiata)* and 2 acacias *(Acacia decurrens* and *A. melanoxylon)*. No record was taken of injury to ornamental or fruit trees in the adjacent private properties although pine, walnut, and apricot trees which had been killed were observed along Sherman Way between Reseda and Shoup Boulevards. In 1943, at the northwest corner of De Soto Street and Sherman Way, fifteen citrus trees in a home orchard planting collapsed during the two-week period between February 2 and February 16.

Some kinds of trees showed slight symptoms of injury or none at all where they were interplanted with deodars or magnolias which were severely injured or killed. The She-Oak *(Casuarina Stricta)* and the Bottle Tree *(Sterculia diversifolia)* gave no apparent evidence of injury. Tip burning and yellowing of pinnae and leaf blades were the only indications of injury observed on *Phoenix canariensis, Washington* and *Trachycarpus fortunei* palms.

The symptoms of decline or collapse will vary with the extent to which the functional root system of an individual tree has been impaired or destroyed. Partial destruction of the root system becomes apparent as a yellowing and shedding of the needles or leaves and a dieback of the main stem or lateral branches as illustrated in ***Figure 1.*** Only the lowest branches of the conifers may remain alive and retain their needles. Some weakened bud development and production of yellowish-green needles was noted after the first needle casting on less severely injured trees. In cases of collapse as shown in *figure 2,* root impairment has occurred to such an extent as to prevent the intake of sufficient water to maintain life in any of the above ground parts of the tree. A sudden needle casting, defoliation and death of the tree results.

Decline or collapse symptoms may not appear until some time after this root injury has occurred. The trees along Sherman Way showed no symptoms of the root injury during the cool, cloudy overcast weather prior to the latter part of May 1941 although the damage to their root systems had occurred earlier. With the advent of clear warm weather, the water requirements of these trees increased to compensate for the greater loss of moisture by transpiration from the leaves or needles. The trees then abruptly exhibited symptoms of decline or collapse commensurate with the extent of their loss of roots and consequent inability to absorb moisture from the soil.

Two of the collapsed deodar trees were pulled with park department equipment and the root systems examined. All of the main and lateral roots below the three to four foot level were found to be rotten and decomposed. It seemed evident that these roots had been dead for a number of years and that the trees had been sustained subsequently by the remaining lateral roots which were spread horizontally in the soil within four feet of the surface. No live feeder roots were found on examination of these laterals. Areas of decayed root bark and an extensive faint blue to purple discoloration of the wood tissues was notable.

Environment Factors Related to Decline

Some of the environmental conditions which seemed to have a more or less direct bearing upon the incidence of decline or collapse of the trees in this area are rainfall, topography, soil types and structures, drainage and water table levels and the presence of toxic materials.

Decline of plants is most general in the late spring following heavy and prolonged rains during the preceding winter and continuing into the early months of spring. High water tables develop and persist in those areas of soil with poor or impeded subsurface drainage. A persistant excessively wet condition of the soil in the root zone appears to be an important contributing condition. Rainfall data is therefore of particular interest as it relates to this condition. The rainfall for the months from December to April during the last three winter and early spring seasons recorded at Chatsworth by the Los Angeles County Flood Control is given below in inches.

	1940-41	1941-42	1942-43
Dec.	8.18 in.	3.77 in.	1.45 in.
Jan.	3.77 in.	.41 in.	12.96 in.
Feb.	13.31 in.	.97 in.	3.14 in.
March	8.61 in.	1.22 in.	5.49 in.
April	3.09 in.	2.68 in.	1.11 in.
Total	36.96 in.	9.05 in.	24.15 in.

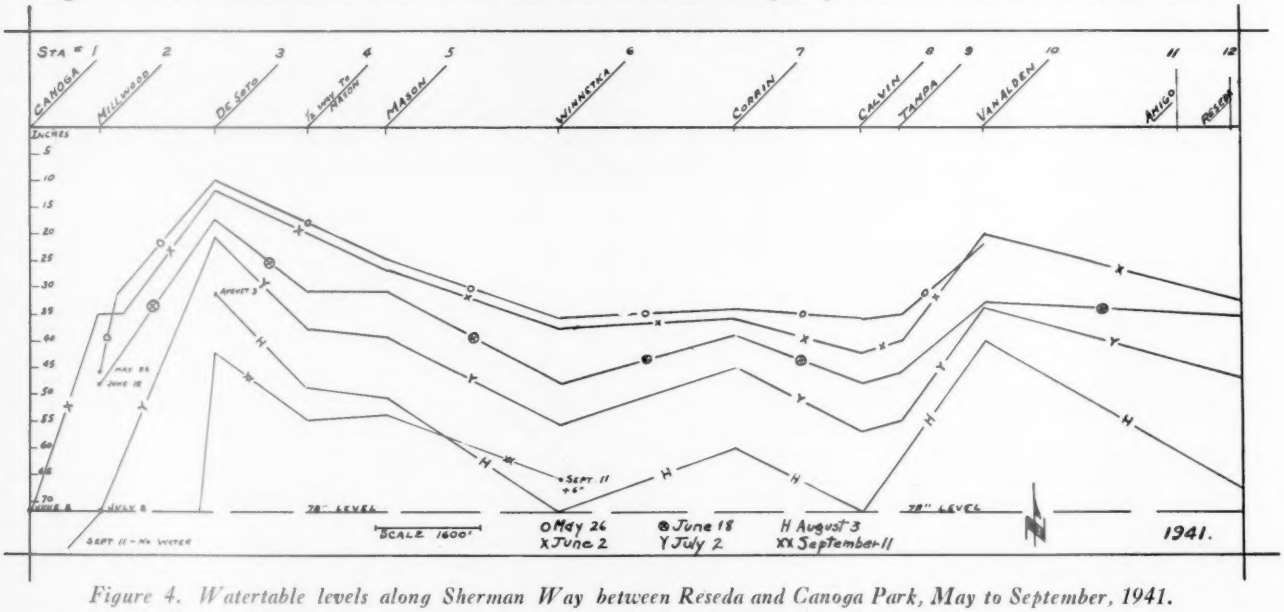


Figure 4. Watertable levels along Sherman Way between Reseda and Canoga Park, May to September, 1941.

The section of Sherman Way along which the greatest number of trees were severely afected or killed was precisely the same as outlined earlier by Weir. It extends from a mile east of Reseda (Marion) westward to about a mile beyond Canoga Park (Owensmouth). It is situated here within the valley having the higher lands with a fair slope lying next to it to the north. The land to the south is relatively flat with a slight slope to the southeast toward the shallow drainage channels which extend westward from the basin of the Sepulveda dam.

Figure 3 is a tracing from the soil map of the San Fernando Valley to show the soil types present in this particular area. It should be noted that this section of Sherman Way lies within and traverses the length of an irregular area of Yolo silt loam soil. North of this area are located the lighter textured more water-permeable soil types of the Yolo series. It is bordered on the south by a continuous band of Yolo clayloam of heavier texture and lesser permeability. Below this band are the still heavier, less water-permeable soils of the Dublin series. The occurrence and persistence of a high water table in this area following seasons of heavy rainfall can readily be accounted for. Drainage water from the higher, lighter textured soils to the north accumlates in this area due to the much slower movement of water through the soils of heavy texture below.

Measurements of the water table levels at fixed stations along Sherman Way from Reseda to Canoga Park were recorded from May to September in 1941. These are shown in *figure 4*. It shows that the water table at the lowest point of thirty inches below the ground surface at Winnetka Street on May 26 had not receded to the six foot level until August3. The highest point of ten inches below the surface on May 26 was at the De Soto Street station. The following September, the water table level at this station was only forty-two inches below the surface.

Records of water table levels were taken at some of these same stations in February and March 1943 during the rainy season. The following are the measurements in inches from the ground surface to the level of the water table.

This waterlogged condition and consequent lack of aeration of the soil in the root zone has long been recognized as an important factor in the decline of trees and other plants. Klotz and Sokoloff in a recent paper cite the earlier observations and investigations bearing upon the relation of wet soil conditions to decline of citrus and avocado trees. To ascertain the possible presence of

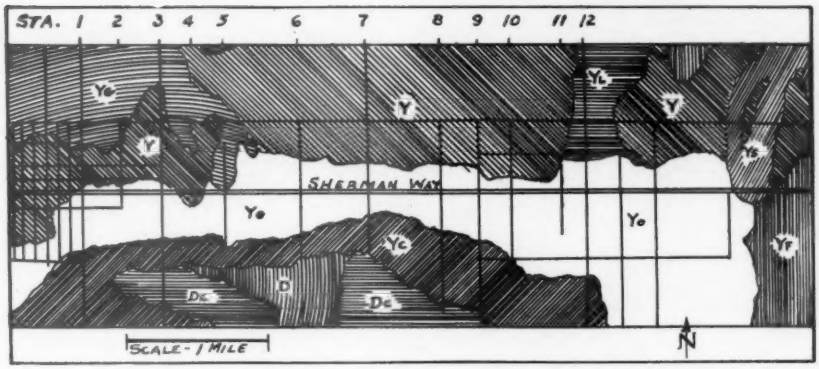


Fig. 3. Tracing from San Fernando Valley soil map showing soil types in area bordering Sherman Way from 1½ miles east of Reseda westward to Canoga Park. Y—Yolo loam, Ff—Yolo fine sandy loam, Yg—Yolo gravelly sandy loam, Yl—Yolo silty clay loam, Ys—Yolo sandy loam, Yc—Yolo clay loam, D—Dublin clay loam, Dc—Dublin clay adobe.

toxic materials in sufficient concentrations to have produced root injury to trees in the area, a sample of water was collected from the hole at the De Soto Street and Sherman Way station June 10, 1941. The analysis and hydrogen ion determination of this water sample were as follows:

pH	Kx10^5 @ 25° C	Boron P.p.m.	Equivalents per million							
			Ca	Mg	Na	CO_3	HGO_3	SO_4	Cl	No.$_3$
7.30	620	3.1	36.6	1.3	12.4	0	6.9	30.1	17.4	3.2

The high specific electrical conductance (Kx10^5 25 C) shows this water to have been strongly saline. The boron concentration was also high. Irrigation waters having a conductance greater than 300 and a boron concentration of more than 2.0 parts per million are regarded as injurious to most plants and unsatisfactory for all but the most tolerant kinds.

Two water samples collected at the same station during February and March 1943 gave conductance measurements of 639.6 and 620.0. Determinations of the nitrite in these water samples as made by V. P. Sokoloff of the Citrus Experiment Station, Riverside, California were 13.0 and 8.0 gammas nitrogen per liter as No. 2 respectively.

A concentration of 2 gamma or more is injurious to the roots of many plants. In their experiments, Klotz and Sokoloff found nitrite injury to the roots to be associated with a wilting and collapse of citrus and avocado trees. As a result of this root injury the capacity of the plant to absorb water was reduced and the roots rendered more susceptible to attack by root rotting organisms. These organisms as well as others present in the soil are known to have the capacity of reducing nitrates to nitrites. Root injury as a consequence of a high nitrite concentration is due to its action as a respiratory poison.

Sta. 170	Location	February 9	February 16	March 2	March 16
2	MillwoodSt.	34.5 in.	40.0 in.	30.0 in.	25.5 in.
3	De Soto St.	surface	3.0 in.	surface	surface
4	½ way to Mason St.	18.0 in.	25.0 in.	11.0 in.	12.0 in.
5	Mason St.	12.5 in.	18.0 in.	9.0 in.	surface
6	Winnetka St.	32.0 in.	39.5 in.	25.0 in.	16.5 in.
7	Corbin St.	46.0 in.	56.5 in.	39.5 in	20.0 in.
8	Calvin St.	35.0 in.	48.0 in.	28.5 in.	17.0 in.
9	Tampa St.	24.0 in.	29.5 in.	18.0 in.	12.0 in.
10	Vanalden St.	17.5 in.	23.5 in.	9.5 in.	5.0 in.
11	Amigo St.	47.0 in.	56.0 in.	27.0 in.	22.0 in.

Thru the Microscope

(Continued from page 6)

pathologist, at a meeting of the New Jersey Federation of Shade Tree Commissions last December, concluded that on the basis of the work conducted by him and his colleagues, he was not in a position to recommend tree injections as a means of curing trees affected by the Dutch elm disease. Although some promising results were obtained with a few of the chemicals, most of the chemicals tested failed to produce any beneficial response.

More recently, Zentmyer and Horsfall (2) reported that organic chemical introduced into the water-conducting system of plants, lessened the wilting and spread of the disease. These researchers report:

"In injection experiments in 1942 on 500 elms, 6 to 10 ft. tall, quinone, pyrogallol, p-nitrophenol, 8-hydroxquinoline sulfate, and hydroquinone again reduced the severity of Dutch elm disease. Some of these chemicals have been shown to inactivate the toxin of *Ceratostomella ulmi* in vitro. Results on 70 Verticillium-infected maples, 34 of which were injected with 8-hydroxyquinoline sulfate in 1941, showed that 56 per cent of the treated trees and 28 per cent of the checks had improved or shown no further decline in 1942."

How much the war will curb research on shade trees and how long it will be before a fool-proof tree injection technique is devised, are two questions not easily answered at this time.

Dutch Elm Disease: Lack of manpower and money have done much to curb the 12-year battle to control the Dutch elm disease. Despite these limitations, however, E .G. Brewer (3) reports that the campaign to curb this serious threat to the elms in the eastern United States is being continued. According to his estimates, New York State has the largest area infected by the Dutch elm disease, more than 5,000 square miles. New Jersey, Connecticut, Pennsylvania, and Massachusetts follow in that order. Here are some overall figures presented by Mr. Brewer:

"Up to November 14, 1942, a total of 65,151 elms have been found infected in 10 states. Nearly 6,000,000 elm trees have been removed as hazardous because of the presence of bark beetle carriers or for reasons other than being known victims of the disease. In addition, more than 300,000 elms have been pruned to remove beetle-infested material. Approximately 125,000 square miles have been scouted to locate such disease and insect material."

To which yours truly (who helped on the Dutch elm disease project 10 years ago) says: "That's covering an awful lot of trees and territory!"

To bear out Mr. Brewer's statement that the battle against the Dutch elm disease still goes on, Jones and Moses (4) present some interesting data on how the disease spreads.

Insects, they say, are important in two ways. First, the fungus adhering to the insects may be spread directly to a living elm during the time the insect feeds and thus cause infections. Second, the insects may establish the fungus in dead or dying elm wood, where their young or other insects may in turn carry the fungus away when they emerge.

Jones and Moses decided to find out which insects are involved and which are most guilty, in the hope that such information would enable more rapid progress in the eradication of the disease.

They placed healthy felled logs at a half dozen places in the heavily infested areas of New Jersey and New York in the spring. Throughout the summer and early fall all the insects found on the surface of these logs were collected and isolations of the Dutch elm disease fungus attempted.

The two insects known to be the most important spreaders of the fungus *Scolytus Multistriatus* and *Hylurgospinus rufipes* were found to be most abundant. Of these, about 6 per cent of the former and 5 per cent of the latter harbored the Dutch elm disease fungus, *Graphium ulmi*. Among the contaminated beetles collected, the number of males and females was about equal.

Root Distribution: More evidence is slowly accumulating that no simple formula can be used to show where the bulk of the "feeder" roots of a tree are located. As more kinds of tree root systems are carefully studied, it becomes evident that the feeder roots may be in abundance anywhere from the root crown out to a considerable distance beyond the ends of the branch spread.

Davis (5) made careful observations on a 21-inch D.B.H. Austrian pine with a crown spread of 26 ft. and about 50 ft. high. He found that the greatest mass of mychorizal roots was in an area 3 to 8 feet from the root crown,—underneath a thick layer of humus formed from the normal pine needle fall.

Obviously any application of fertilizer concentrated underneath the outer drip of the branches would have been of little benefit to those roots best able to use nutrients.

Davis also noted that the root system of an Atlas Cedar with a D.B.H. of 12 inches, crown spread of 22 feet and height of 37 feet, was concentrated in an area slightly over 3 feet from the root crown with an occasional root not more than 8 feet away. Here again the application of a commercial fertilizer according to standard recommendations would do little good.

Perhaps when this war is over and when there are no more limitations on fertilizers and manpower, someone might foster a long-time research program to look into the matter of root distribution on shade and ornamental trees. It may be that every tree species will have to be fed a different way, but then what are experts for?

Aerial Roots: Three men with long experience in cleaning out crotch cavities in old trees have often found well-developed roots high up in the tree. Although such an observation is fairly common with tree men, very little has ever appeared in print on the subject.

Aerial roots begin their development at a point just above any extensive trunk injury. Such was the case in a 50-year-old elm called to my attention by my friend Carl Witte, Horticulturist for the Essex County (N. J.) Park System (6). The main body of the root (nearly an inch in diameter) started above an injury about 20 ft. from the ground, and grew downward nearly to the ground level. The root system developed beneath dead bark on the north side of the tree, radiating fan-wise down the trunk so that the smaller roots covered an area of more than a foot in width beneath the dead bark near the ground level.

Nesbit (7) also described and presents an illustration of well-developed aerial roots in a large red oak growing in North Carolina.

References:

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(2) Phytopathology 33; 16-17, 1943.
(3) American Forests 49: 75-76, 94, 1943.
(4) Jour. Agr. Res. 66: 77-85, 1943.
(5) Morris Aror. Bul. 4: 27-28, 1942.
(6) Nursery Disease Notes 15: 7-8, 1942.
(7) Plant Physiology 17: 689-690, 1942.

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The beautiful 54-year-old Goldenrain in full bloom at Missouri Botanic Garden. (Right) Flower panicle and classic foliage of Goldenrain.

A Goldenrain in Missouri

AUGUST P. BEILMAM
Missouri Botanical Garden, St. Louis, Mo.

Over a year ago the editor intimated that he would accept an article on the "drought resistant" Koelreuteria. Much search and research discloses that this tree is not only inured to dry weather but absolutely unaffected by the ministrations of the tree surgeon. An article in the Missouri Botanical Garden Bulletin September, 1915, calls it "a tree of charming habit and beautiful appearance but not well known in St. Louis."

If resistance to dry weather increases popularity then we discover that in the ensuing 28 years the tree has become notorious. So well known in fact that a number of county court house lawns boast a specimen of flowering size. A number of small trees can be found scattered through the gardens in both the city and the county. Of course the Koelreuteria can be obtainable from a nursery today but we believe that we are correct in claiming that most of these younger trees are the progeny of a tree planted by Mr. Shaw before 1885, at a time when he was actively adding to what is now the Missouri Botanical Garden. This oldest tree is about 24 inches D. B. H. and perhaps 30 feet tall with a spread almost as great. The seed from this tree germinates readily and is always collected by the more ardent gardeners who visit the Botanical Garden. The Koelreuteria is perfectly at home in the Middle West and this is best shown by the fact that volunteer seedlings are likely to be found in any shrubbery bed.

Technically Koelreuteria paniculata (Laxm) is a native of Eastern Asia. Like most trees from that part of the world the branching is contorted and in maturity this produces a rather low wide spreading round-headed tree. The flowers which are very showy occur at a time when few of our trees are in bloom. They are produced in terminal panicles. The fruit is enclosed in a bladdery sule and these become conspicuous in middle summer and remain on the tree until fall. On the whole this tree is a very satisfactory ornamental subject in the Middle West since it has showy flowers and fruit in addition to its other advantages. During a very dry cycle from 1930 to 1936 it was one of the few Asiatic species which did not collapse. This is a strong recommendation for increasing its planting.

It has been intimated that in addition to drought resistance it is also shockproof under the ministrations of the "tree doctor." Another article in the Missouri Botanical Garden Bulletin in June 1917 lays bare the "inner communing between the tree doctor and the patient." Historically this Bulletin is of much interest but we are concerned with the Koelreuteria and not the history of tree surgery. However, this article is illustrated with several pictures of this large Goldenrain tree, the first illustration shows the tree with an "improper" concrete filling. An examination shows that this trunk cavity was filled and trowled smooth, presumably without removing the decayed wood and certainly without bothering to cut a bark edge. This filling may have been installed as early as 1900 for we have no record of this work. The article stated that this filling was removed in 1917 and that a "proper" one was installed at that time. The second cavity job shows the great advance made by tree surgery in those years. This cavity is pointed at top and bottom and has a proper bark edge. There is also some indication that steel reinforcing was used—perhaps in the form of lip bolts. In any event the second filling has several sections made of asphalt and some of concrete. Seemingly these are but thin shells and the remainder of the cavity is filled with ashes, sand and sawdust. The tree has partly grown over this earlier work and a model '43 filling has not been installed.

The Goldenrain tree has no serious diseases or pests. The growth is rapid and it begins to flower when 6 to 8 years old. A spreading round topped crown limits its use to larger gardens. Just the same, any tree which can undergo two major operations during maturity, and remain happy during some 58 or more mid-western summers, should be given a place in many gardens.

Feed the Trees

By C. H. SPURWAY
Professor of Soils, Michigan State College

When one looks at a tree he sees the visual evidences of its being. Its size, shape, color and general appearance has its appeal, either favorably or unfavorably as the case may be. It is, however, the invisible, natural processes that take place within the tree, and the soil, by which the tree grows and develops its size, form and other external characteristics.

Of great importance in the life history of a tree is the mineral nutrition obtained from the soil. Like other plants, trees utilize mineral nutrients in a certain definite proportion for their best growth. When the proper proportion of these mineral nutrients cannot be obtained from the soil, tree growth suffers in some respect. One of the most important factors of good tree growth, therefore, is the supply and balance of available mineral nutrients in the soil.

In the forested regions, the native vegetation quite completely covers the ground. The plants gather water and nutrients from the soil. Transpired water maintains the humidity of the air. Carbon is taken from the air, and with the energy of sunlight foods are synthesized in the leaves which, in turn, are utilized in growth processes. When the deciduous trees drop theitr leaves, and the vegetation of the forest floor goes back to the soil, a considerable amount of organic matter containing mineral nutrients is returned to the soil from whence they are used again perhaps by the same tree. Thus the natural processes set up a continual rotating fund of soil fertility from soil to plant and then back to the soil, again and again throughout the years. This is Nature's way of sustaining herself. The quantity of mineral nutrients increases in the surface soil due to the pumping action of the tree roots on the available nutrients of the lower subsoil, and the return of vegetation residues to the soil surface. The carbon, nitrogen and organic matter supply of the soil also increases. A soil of some type is formed. These processes can maintain the fertility of a soil indefinitely, or build it up to a high state ,so long as there are no major counteracting factors. The forest maintains itself by using the soil fertility over and over again.

The forest makes its own soil conditions to a considerable extent. It conserves water by holding the precipitation and by decreasing drainage and evaporation from the soil. It rotates the fertility, builds up the organic matter content and protects the soil from wind and water erosion. Thus the forest can, from a small beginning, spread its borders gradually to occupy a large area of land in time. This is objective fertility maintenance and soil management.

Now, some of our shade trees are the original trees of the forest and some have either been planted since the land was cleared or on forestless locations. In any case, trees standing alone are not growing in their natural environment. They are orphans in the sense that they do not receive the protection and nutrition afforded by the close association of other trees. They need attention by man to take the place of the more desirable conditions of their natural habitat. Lone trees furnish examples of intensive cropping, as a comparatively large weight of leaves and wood grow year after year on a relatively small area of soil. In cities, parks and on estates where the fallen leaves and the old trees are taken away, there is little return of the natural fertility to the soil, and rapid soil exhaustion may occur. Especially the larger, older trees often lack mineral nutrients and also water in dry periods.

When trees show signs of poor growth of any description, therefore, it is time to send for the Arborist. But a mere visual inspection of the tree will not be enough. A thorough examination of the soil under the tree may reveal serious nutrient deficiencies which will have to be corrected by fertilization in order to save the tree.

In a preliminary examination of soils under old trees and trees showing poor growth symptoms, by means of soil testing methods, it has been shown that trees can quite completely exhaust the soil of available nutrients. Any single deficiency or any combination of deficiencies may occur, showing that poor tree growth is not due to one or two causes in particular, but that it may be due to a number of causes from the soil fertility standpoint alone.

Because many soil locations under trees have more than one nutrient deficient, it will be difficult to correlate soil deficiencies, or the need of specific fertilizer treatment with any observable symptom on the tree. Also, in this connection, poor tree gorwth may be due to causes without the soil. For instance, leaf chlorosis is not always associated with a definite soil deficiency, but it may be found associated with other causes. Gas, smoke, heat or dust containing chemicals, or parasitic or virus diseases may also injure trees growing in cities or along roadsides. It is relatively easy to determine if a tree is not growing properly, but to find the cause and apply the remedy is a different matter.

In practically all of the cases of poor tree growth examined to date, nutrient deficiencies were found in the soil. The situation is a serious one, and it will become more serious as time goes on. It is believed that many localities will lose the fine rows of old shade trees along streets and roadsides, and the beautiful specimens in parks, if the nutrient supply of these trees is much longer neglected.

Two things can be done to help save the trees. They can be fertilized regularly and watered during dry periods. First, it will be necessary to know what the soil deficiencies are in order to apply the right kind of fertilizer. Regular applications of fertilizer at periods of two to three years, at first, and at different places under the trees, if the fertilizer is watered or blown into holes bored in the soil, is a good plan to follow. Broadcast applications of fertilizer may be made on sandy soils where it will be washed gradually into the soil by watering or by rains. Fertilizer broadcasted on heavy, impervious soils, however, is not very effective. Diagnose the soil conditions first and then apply the treatment suggested by the results of the diagnosis is the economical and effective way to feed trees. A hit-or-miss procedure may not correct the most limiting soil fertility factor.

In the maintenance of public parks, new plantings of trees can be made from time to time, in the more open spaces, or at the edges of established groves, where the soil fertility of the park area has not been exhausted by previous tree growth. It is not a logical procedure to plant a tree on the exact site of an old one without knowledge of the soil fertility conditions and of the measures necessary to properly nourish the new tree. A continuous, rotating, planting plan will more fully utilize soil fertility and replace the old or injured trees.

The objective of any plan of soil fertility maintenance for trees should not be one of tree care by hypodermic shots of a standard fertilizer to sick trees on a hit-or-miss basis. A well-considered plan of soil fertility improvement or maintainence based on actual soil deficiencies, or soil improvement needs, in order to keep the trees healthy, or to prevent them from becoming sick, is a more logical objective for park superintendents. In most cases it will neither be necessary nor practical to attempt to cure all soil deficiencies completely at one time. The most limiting factors of tree growth are the ones to attack first. When it is known just what a soil needs for general fertility improvement, a little effort here and there consistent with the most immediate soil needs and available funds and labor, will in the end produce permanent results, if the plan is not too long delayed.

Arboriculture Without Arborists

By C. C. HARTNEY
Hartney & Amalia, Inc., Boston, Mass.

The above title reminds me of that old song, "Yes, We Have No Bananas." In fact, I think I could write a pretty good parody on the song and apply it to the tree business today. Yes, we have everything with which to do a real good tree job. We have cable and eyebolts, woodscrew and wound dressing, but Yes, we have no tree surgeons today. We have some old-fashioned sprayers, long suffering trucks, but Yes, what the Hell to do with 'em?

There is the old proverb—"Necessity is the Mother of Invention," and ain't it the truth? To begin with, we have some blessings. We don't have to worry very much about sales, because it's a Seller's market these days. Most of us have a back log of orders on the books, and our charges should be commensurate with the times. People cannot and do not expect super-service; furthermore, now is the time to weed out the chronic complainers and the slow payers. I have always maintained that the tree business has suffered much in this respect. Pruning operations need not be confined to trees; too many of us have sold and serviced small jobs that actually cost us money to execute. Now is the time to get rid of these accounts for once and all.

A large percentage of our younger men are now in the Armed Services, but some former employees now in Defense Industries are working part time with us. Usually Defense workers are employed eight hours a day on varying shifts. For instance, a former foreman is on the 3 p. m. to 11 p. m. shift and can work with us four to seven hours as needed. Another chap is in the Shipyards from 11 p. m. to 7 a. m. and is available from 1 p. m. until 7 p. m. Most of the men in Defense Work say their jobs are not strenuous, and invariably your average "tree skinner" wants to keep out of doors and in touch with Mother Nature. In any event, we have not noticed any let-up in the quality or quantity of work done by these part-time employees.

Like everyone else, we are trying older men in certain types of work, such as in shrubbery and fruit tree pruning, fertilizing and spraying. Some of these older men have had experience in horticulture and make very satisfactory workers. Dependability is probably the outstanding characteristic of this group. We believe too that women could be used for truck driving and to a limited degree in spray work.

In talking with clients or prospects, stress is being laid on the work that can be done with a minimum of skilled help. We are encouraging all fruit tree work, pruning, fertilizing, spraying, thinning and transplanting of shrubs and small trees, and the taking down of dead or dangerous trees. Incidentally, most of the jobs now call for the removal of brush and debris, which, of course, can be done by unskilled labor. With the exception of emergency work, cabling, pruning and surgery is contracted with the stipulation that it be done at our convenience.

I suppose all this sounds like a Revolution in the tree business. It is! But speaking personally, I've had a little Revolution all my own, because after fifteen years in the Sales and Executive end of the business I have been working in the field with the men for the past three months. Fortunately, I had three years of field work back in the middle twenties, and this year for me "life begins at forty"—I find I can still get around in a tree!

Maybe all this isn't Arboriculture Without Arborists, but it has done one thing—it's put the Boss back to work and that's where a lot of us belong!

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Chemotherapy

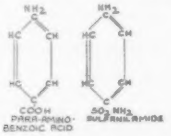
(Continued from page 7)

Many of the small details involved in the growth of a fungus may seem unimportant at first consideration. They may be of great significance in chemotherapy, however, as they may furnish the very key needed in chemical control of the disease which the fungus causes.

Vitamins and Fungi

Plants as well as animals have certain vitamin requirements, and the lower plants, including fungi, are no exception. It has recently been discovered (1,5) that vitamin B6 (Pyridoxine) is necessary for the normal development of the Dutch elm disease fungus. How can this knowledge be of use in experiments on control of the disease? Recent work in medical chemotherapy furnishes an example.

According to one of the most plausible recent theories, sulfanilamide, and some of the other sulfa drugs, are effective against bacteria (Streptococci, etc.) causing diseases of man because of the structural resemblance of the molecules of these chemicals to those of certain vitamins required by the bacteria.



For example, the sulfanilamide molecule has a chemical formula very similar to that of one of the vitamins necessary for growth of Sterptococcus: para-aminobenzoic acid, as shown in the structural diagrams of the two molecules: Hence sulfanilamide effectively prevents or controls Streptococcus infection because the bacteria "mistake" this poison for the similar vitamin. (The actual mechanism involved is complex and not fully understood, but probably involves competition for positions on vital enzymes.)

It is thus apparent that one of the approaches to chemical control of the Dutch elm disease involves discovering a usable chemical which the fungus might similarly "mistake" for one of the vitamins which it requires. Dr. W. J. Robbins, of the New York Botanical Garden, tested a number of chemicals similar to vitamin B6, the vitamin required by the Dutch elm disease fungus, and found one compound which was toxic to the fungus and may prove to be very interesting in control experiments. One obstacle in this particular approach is that in the work with bacteria it has been found that the presence of very small amounts of the vitamin will counteract

Wilting and curling of leaves on young American elm affected with Dutch elm disease.

the effect of large amounts of the poisonous chemical.

The identity of this toxic substance is not yet known but is the subject of further investigation here. A highly significant point at present is that the toxin can be neutralized or made ineffective in the laboratory merely by adding measured amounts of certain organic chemicals (2). Dr. Frank Howard of Rhode Island State College has found that the toxin involved in bleeding canker of maple is similarly antidoted by an organic chemical (3).

The next step obviously is to use these chemicals, which neutralize the fungous toxin in the laboratory, in actual tree injections. Using this approach it might not be necessary to attempt to kill the pathogen; if the fungous toxin can be neutralized or destroyed, the fungus might be as harmless as blue-green algae growing on a tree trunk. This opens up an entirely new approach to control of the disease, and gives promise of being a highly productive line of investigation—not only with regard to the Dutch elm disease but also in control of other tree and plant diseases.

Effective Chemicals in Laboratory

We have learned a great deal about the effect of many organic chemicals on fungous toxins and on the fungi themselves, in culture in the laboratory. Several chemicals, including compounds in the 8-hydroxyquinoline group, and certain dyes, will prevent growth of the Dutch elm disease fungus in culture when only one part of the chemical is used to 50,000 or even 100,000 parts of nutrient solution. The effect on other vascular fungi, including species of *Verticillium* and *Fusarium,* is similar.

Some of these organic chemicals also will neutralize fungous toxins in the laboratory. Many of them can be introduced into elm trees and other plants safely in considerable amount at concentrations of 1 to 1000 or 1 to 2000, and hence offer interesting possibilities, since they prevent fungous growth at much lower conecentrations. Direct analogy of course cannot be drawn between laboratory results and field expectancy; a chemical which is fungicidal under laboratory conditions may react very differently when injected into an elm tree.

Field Treatment Methods

Even though highly satisfactory chemicals are developed in the laboratory, a difficult major problem still confronts the pathologist before chemotherapy can be of use. This is the distribution of the chemical in the tree, or other plant.

Present chemotherapeutic methods have generally consisted of introducing aqueous solutions of chemicals into the trunk of a tree, the chemical being fed into bore holes or chisel cuts in the trunk from various types of containers, with or without the use of pressure. This approach has the advantage of ease of application, but has numerous disadvantages which include erratic and incomplete distribution through the tree, disruption of vascular tissues, possibility of introducing wood-rotting fungi, creating loci for emission of slime fluxes and so forth. (A comprehensive article on Methods of Tree Injection, by Dr. Curtis May, was published in the November-December 1941 issue of TREES.)

Introduction of chemicals through the roots, either by soil applications or root immersion or injection would be the ideal method from many standpoints. Distribution should approach that of natural distribution of water and nutrients throughout the plant, and injuries to vascular elements would be eliminated. Obvious disadvantages include the absorption of chemicals in the soil, the sensitivity of the small functional roots to toxic influences, the generally low ratio of amount of chemical absorbed to amount applied to soil, and the mechanical difficulties involved if chemicals are introduced directly into roots of large trees.

Introduction of chemicals by spraying the leaves is another possibility that is being investigated. Chemicals entering the leaves through the stomata, or through the epidermis, may reach the vascular system and there affect fungous toxins or the fungus itself, or may counteract the increase in cell permea-

bility said to be caused by some of the wilt disease fungi.

Chemicals vary greatly in the rate and extent of their distribution after introduction into the vascular system, and in their retention in various tissues of the plant. Little is known at present about these several points. Some of the dyes, for example, are not well distributed through a tree because of their natural affinity for plant tissues and hence the tendency to be removed from the vascular system in lower parts of the tree. Simple ions, such as boron, on the other hand, are readily distributed through entire tree. Injection of a small amount of borax solution through a single injection hole in an elm trunk will result in typical boron injury symptoms in every leaf in the top of a 25-30 foot elm, for example.

Injection Results

Some of the results obtained here on injection of small elm trees (3 to 10 feet tall) with organic chemicals have been highly interesting from a scientific standpoint. Injection before inoculation with the Dutch elm disease fungus has prevented trees from becoming diseased, while injection after inoculation has resulted in retardation of symptom appearance and reduction in severity of disease. In a few cases, similar temporary retardation of disease progress has been obtained with large trees, but many more data are needed on treatment of large trees. Two main obstacles in treating such trees at present are: the difficulties of getting adequate distribution of chemical with present methods, and the practical difficulty in recognizing and treating diseased trees before the vascular systems are severely plugged.

Encouraging results have also been obtained in injection experiments on maple trees infected with *Verticillium*. In addition, highly significant reduction in wilting has resulted from chemical treatments of eggplants affected with *Verticillium* wilt, caused by a very similar if not identical fungus to the one causing wilt of maple, elm, and other hosts. The eggplants were treated by several chemotherapeutic methods, including soil applications, sprays, and injection of small capsules filled with chemical.

These results show that it is possible to introduce appreciable quantities of organic chemicals into plants without injuring them perceptibly, and in so doing at least to retard the development of vascular fungi. In none of these cases, however, has actual control of the disease been attained.

These effects may be obtained because the chemicals are neutralizing the fungous toxins, or because of their direct effect on the fungus itself, or because of their effect on the host plant. In dealing with a vascular disease such as the Dutch elm disease, this effect on the host plant may be of considerable importance. In this disease, if a tree survives one season's infection with enough vigor to develop spring wood normally the following year and "wall-off" the fungus, the tree has a good chance of natural recovery. Hence, building up the resistance of a tree or increasing its vigor by chemical treatment may help to increase this percentage of natural recovery by enabling the tree to outgrow the fungus. This has been one of the aims of our research here.

Conclusions

This brief presentation of the problems involved in chemotherapy for the treatment of wilt diseases has of necessity been primarily a survey of the manifold future possibilities, as no effective control for such diseases has yet been obtained with chemicals. Although at present there is no chemical which can be recommended for control or prevention of the Dutch elm disease or similar tree wilt diseases, definitely encouraging progress is being made on the problem. Any one of a number of possible approaches to chemical control may ultimately lead to an efficient, practical control which will be commercially feasible.

Chemotherapy, when it emerges from the experimental stage, may provide the arborist with a much-needed method of controlling many plant pests. The arborist knows only too well how inadequate our present knowledge is in dealing with the several tree wilt diseases. Internal treatment with chemicals could provide the means for saving or prolonging the life of a prized tree afflicted with one of these fungous diseases; the method also has infinite and real possibilities in curing other tree and plant disease problems—pathogenic and physiological. Miracles should not be expected, but subsequent researches in this field are certain to be of interest to the arborist.

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Authors and Books

The following books may be ordered from TREES Magazine, Box 886, Santa Monica, California.

THIS GREEN WORLD, by Rutherford Platt. Dodd, Mead & Co., New York. Illustrated in Kodachrome and Black and White. 222 pp., $3.75.

While the superb and copious photography makes this book very attractive and informative it is the accurate and exhaustive attention given to detail that makes it one of the outstanding contributions to horitculture in the past ten years. Written for the layman in non-technical language it has as much value for the professional. Many dramatic phases of plant and insect life have been exhaustively studied and beautifully told by the author. This is the kind of book you will read countless times. It is enthusiastically recommended to the readers of TREES.

SHELTER TREES IN WAR AND PEACE, by Ephraim Porter Felt. Orange-Judd Publishing Co., New York, 320 pp., illus., $2.50.

Another fine contribution to your tree library by Dr. Felt. Perhaps the outstanding point of value in this book is the emphasis placed by the author on the value of trees against bombing in future wars. Air warfare has just begun to grow and the author advances some fine thoughts for Arborists and City Foresters to begin evaluating for sale to the public. Many of the mistakes made in this war to date with, and to, trees in the construction of military establishments are brought out. The extensive tree lists for all regions of the country and the individual descriptions round out a volume that makes valuable reading.

TREE EXPERTS MANUAL, by Richard R. Fenska. A. T. De La Mare Co., Inc., New York. 192 pp., illus., $4.50.

A brief resume of some of the chapter titles will give an idea of the contents of this new book. Diagnosis of Tree Troubles; Fertilizing Shade Trees; Lightning Protection for Trees; Environmental Trouble; Dusting; Spray Materials and Formulae; Evaluation of Shade Trees; Shade Tree Laws.

The long experience of the author brings out much valuable information for the eastern Arborist. Of particular value are the chapters on Spraying and Formulae; the author has developed these subjects more exhaustively than other phases of tree care and offers pertinent and specific advice. The suggestion of trees for city streets is open to debate and not as extensive as they could be, however, this field is only lightly dwelt upon.

GUIDE TO THE TREES AND SHRUBS, issued by New York Botanical Garden. Pocket-size Book with a Map gives Location, Also Description, of More Than 300 genera; 2,889 Specias Liste; 20 illustrated. Published by New York Botanic Garden, New York, 75c.

Hardy trees and shrubs at the New York Botanical Garden are the subject of a handy pocket-size catalog which has just been issued by the institution. Designed to be comfortably carried by visitors during a tour of the grounds, it is provided with a folded map to which every genus in cultivation there is keyed. Twenty of the outstanding shrubs and trees are illustrated.

Nearly 3,000 species and varieties of woody plants are now being grown outdoors at the New York Botanical Garden, according to T. H. Everett, Horticulturist, who has written an informative introduction to the book. This is double the number that was listed in 1920, and much of the increase has taken place within the past few years, particularly since the Botanical Garden was fenced and a new area was set aside at a central point in the grounds for the display of flowering shrubs.

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This pocket-size volume shows what can be grown in this region and tells where the specimens of each genus can be seen at the Garden.

AMERICAN SILVICS AND SILVICULTURE, by Edward G. Cheyney. University of Minnesota Press, Minneapolis, Minn. 472 pgs., illus., $5.00.

The first 262 pages of this fine book are devoted to the title subjects. Forty-seven pages are given to major and minor silvical factors; then a classification discussion of the forest areas of the U. S. Silvicultural systems and their application occupy the remainder of the first half. There is much new material, particularly the suggestions that European silvical methods not be applied to American conditions and the suggested methods that should be employed.

Up to the present little has been known or published under one cover regarding the silvical factors of American forest trees. We regard the section given to this subject as ample justification for the book. The 106 species are discussed thoroughly from the standpoint of: Range, types and associates, soil, moisture, light, seed production, growth, and management. This is a book from which anyone, Forester, Arborist, Park executive or Nurseryman will derive untold values. We recommend it highly and wish to add a note regarding the clarity and character of the illustrations.

INDUSTRIAL CAMOUFLAGE, Pratt Institute, Konrad F. Whitman. Reinhold Publishing Co., New York, N. Y., 128 pgs., illus., $4.00.

This is a splendid addition to our camouflage library. It shows miniatures of how to conceal large industrial areas along with much worthwhile, practical facts and figures. In one part where "fast growing trees" are named, we hope this suggestion does not undo the work done by Arborists and others of recent years, namely to discourage the planting of such fast growing trees generally because of their heavy maintenance expense and many other objectionable features.

It is too bad several reputable Arborists were not consulted for tree data.

Other features of the book including methods of creating natural shadows and artificial trees and shrubs are excellent. A worthwile book.

WILD VIOLETS OF NORTH AMERICA, by Viola Brainerd Baird, University of California Press, Berkeley, Calif., 225 pgs., illus. in color, $10.00.

If ever there was published a collectors piece this beautiful and authoritative book is it. There are 82 color plates of the wild violets of North America made from water colors. Each is a lovely thing. The botanical descriptions and other data make this volume one of the basic studies of American horticulture.

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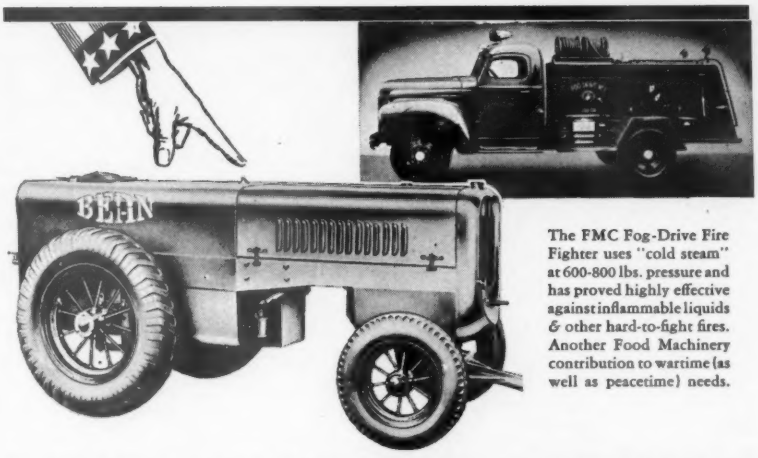

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